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Shibaki

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(54) **CLEANING DEVICE AND FIXING DEVICE**

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(52) **U.S. Cl.**
CPC ***G03G 15/2075*** (2013.01); ***G03G 15/2025*** (2013.01)

(58) **Field of Classification Search**
CPC G03G 15/2075; G03G 15/2025
USPC 399/327, 345, 352
See application file for complete search history.

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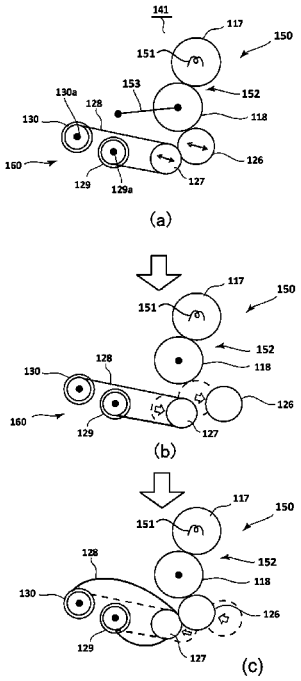
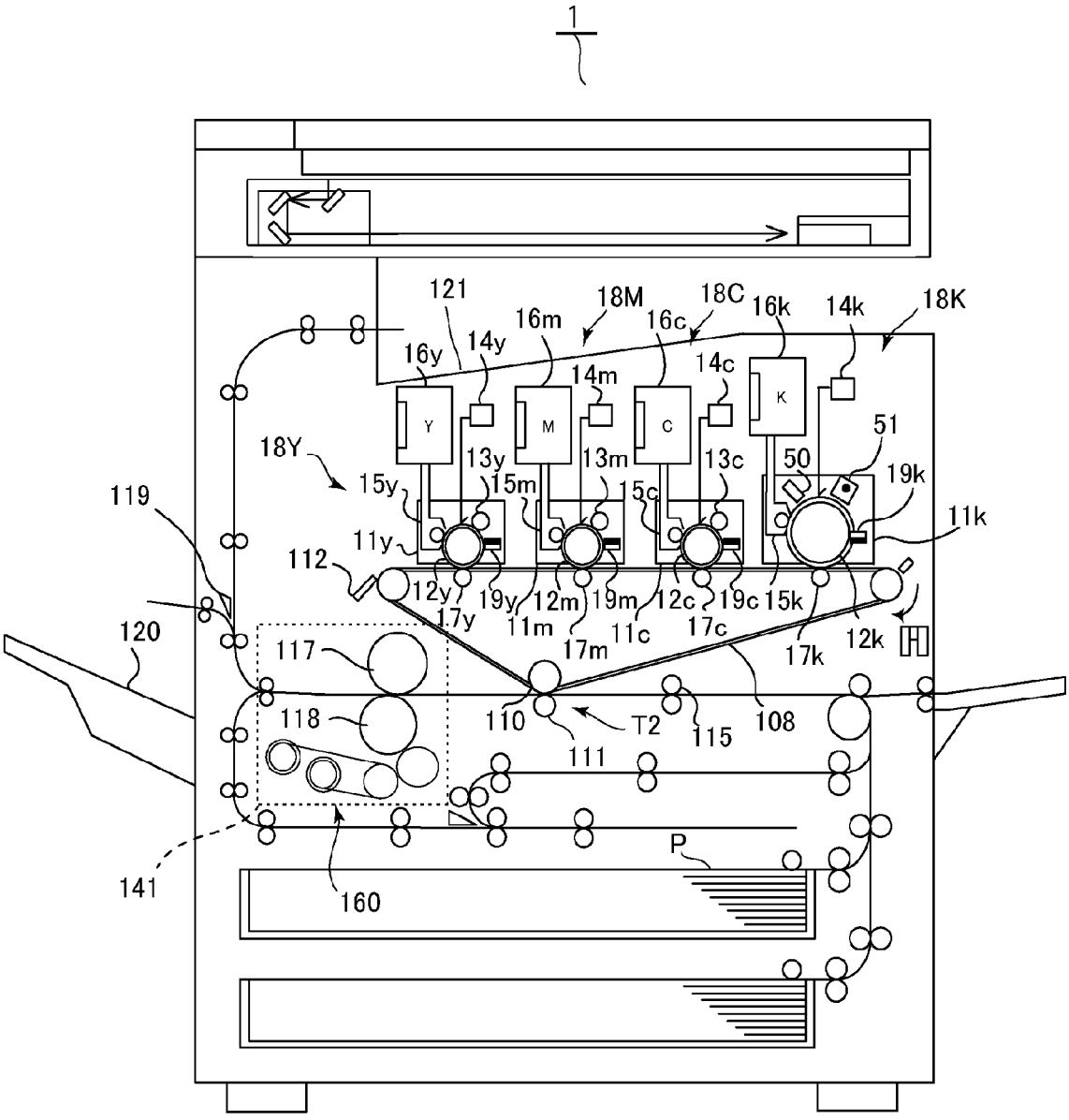
(57) **ABSTRACT**

A cleaning device includes a cleaning unit which includes a web; a first roller, a second roller for winding the web up, a driving mechanism for second roller, a third roller urging the web to the rotatable member, an urging portion urging the third roller toward the rotatable member, and a supporter supporting the third roller while permitting movement relative to the first and second rollers; a moving mechanism for relative movement between the cleaning unit and the rotatable member, between a first position in which the web is spaced from the rotatable member and a second position in which they contact; and a controller. When the mechanism causes the relative movement from the first position to the second position, the controller operates the mechanism for a predetermined duration to substantially eliminate the slackness of the web resulting from the relative movement.

16 Claims, 9 Drawing Sheets




1
121
18M
18C
16k
14k
18K
16m
16c
16y
14y
14m
14c
Y
M
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K
51
18Y
13y
13m
13c
50
19k
15y
15m
15c
119
11y
11k
112
12y
19y
12m
19m
12c
19c
15k
17y
11m
11c
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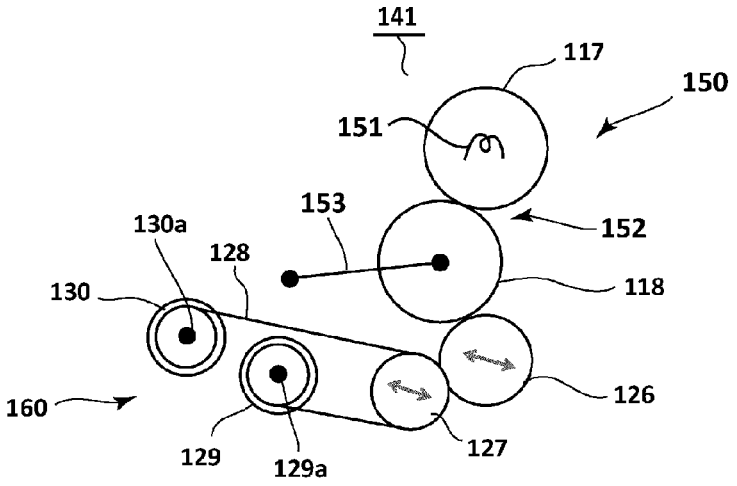
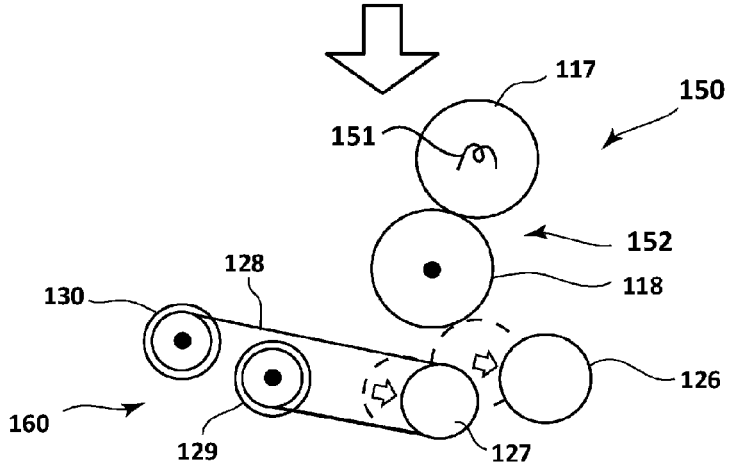
120
17m
17k
117
118
110
T2
115
108
111
P
141
160

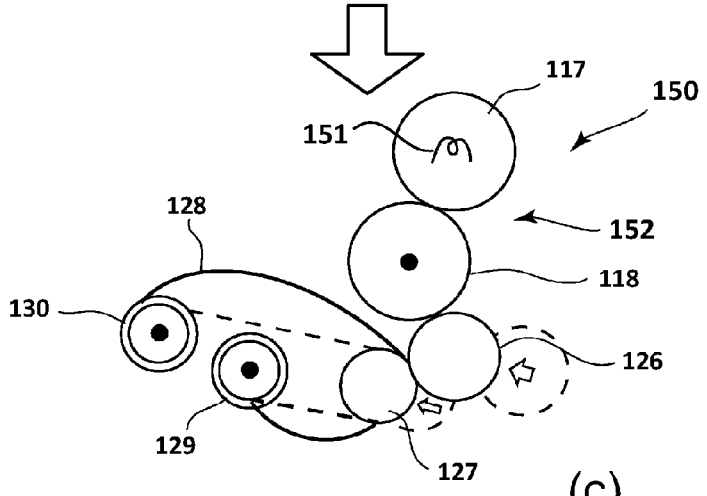
Fig. 1


141
117
150
151
153
152
130a
128
130
118
126
160
129
129a
127

(a)


117
150
151
152
128
118
130
126
160
129
127

(b)


117
150
151
152
128
118
130
126
129
127

(c)

Fig. 2

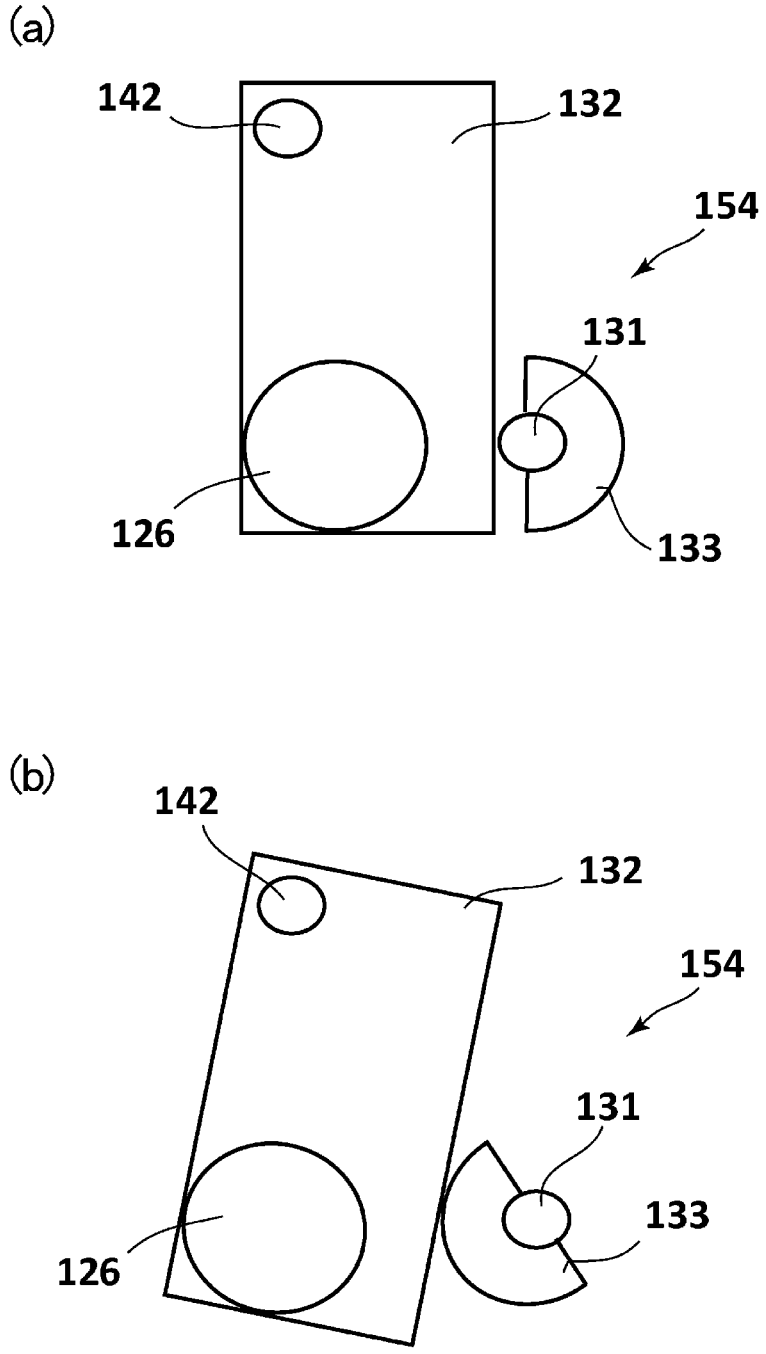


Fig. 3

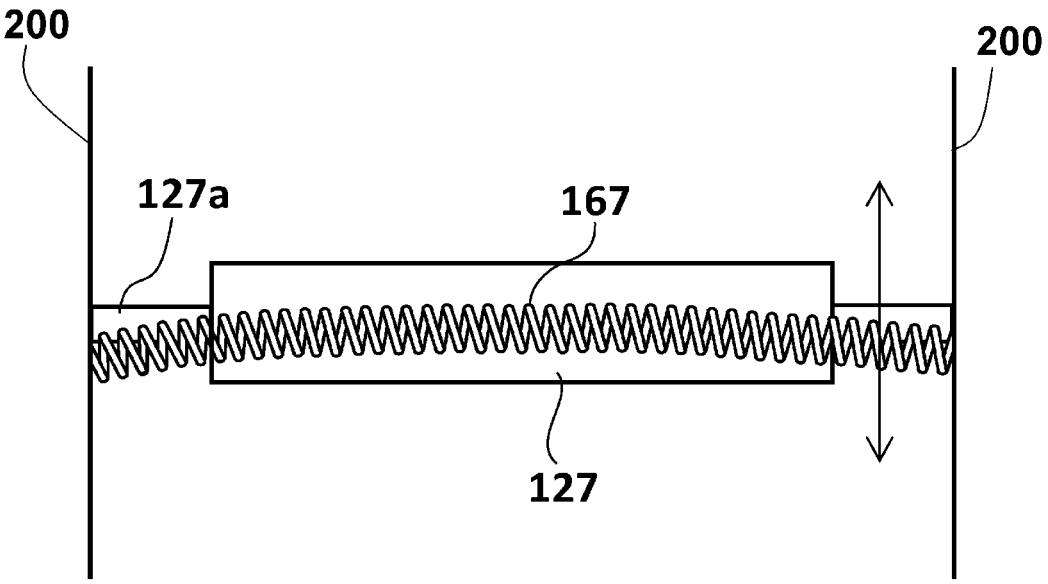


Fig. 4

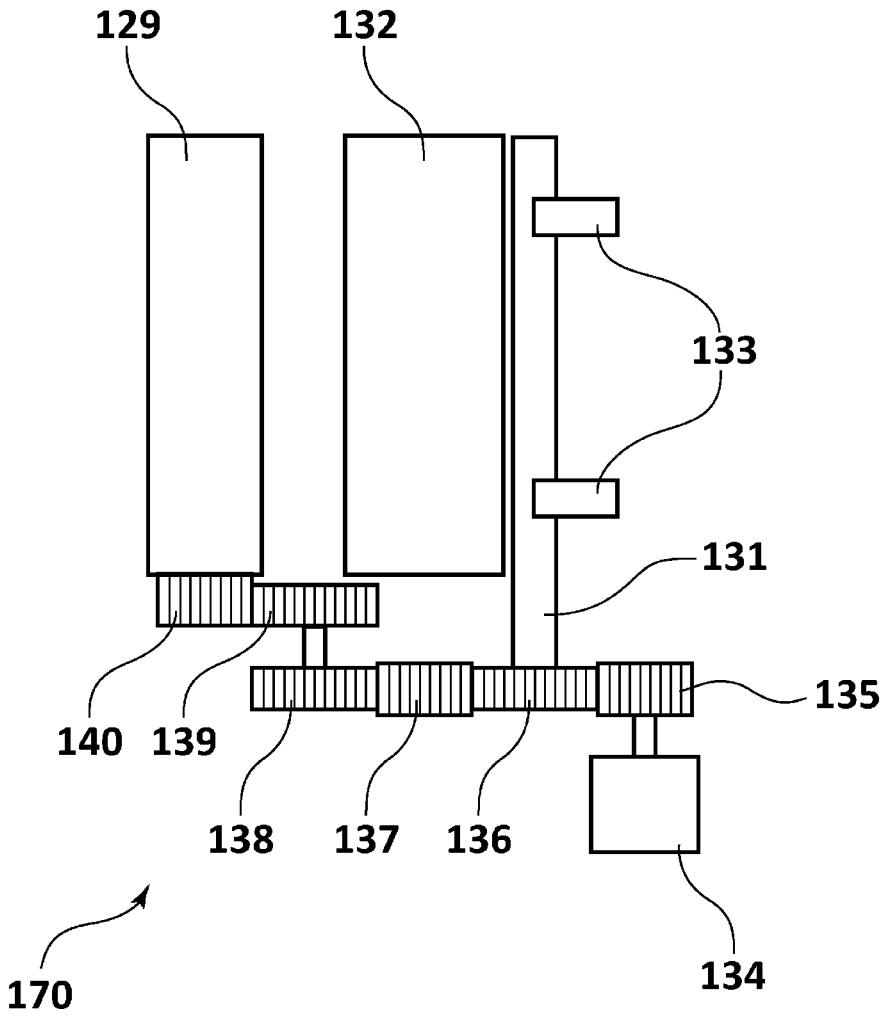


Fig. 5

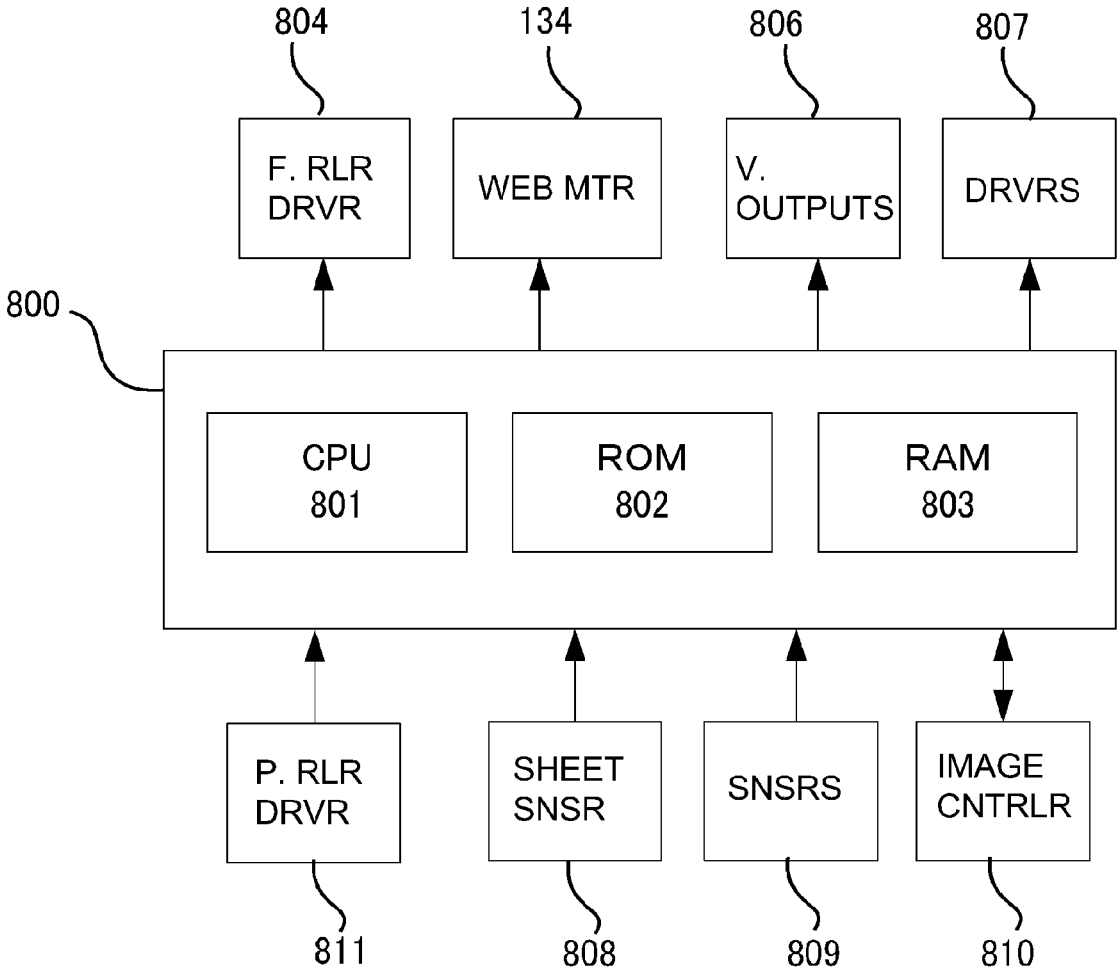

804
134
806
807
F. RLR DRVR
WEB MTR
V. OUTPUTS
DRVRS
800
CPU 801
ROM 802
RAM 803
P. RLR DRVR
SHEET SNSR
SNSRS
IMAGE CNTRLR
811
808
809
810

Fig. 6

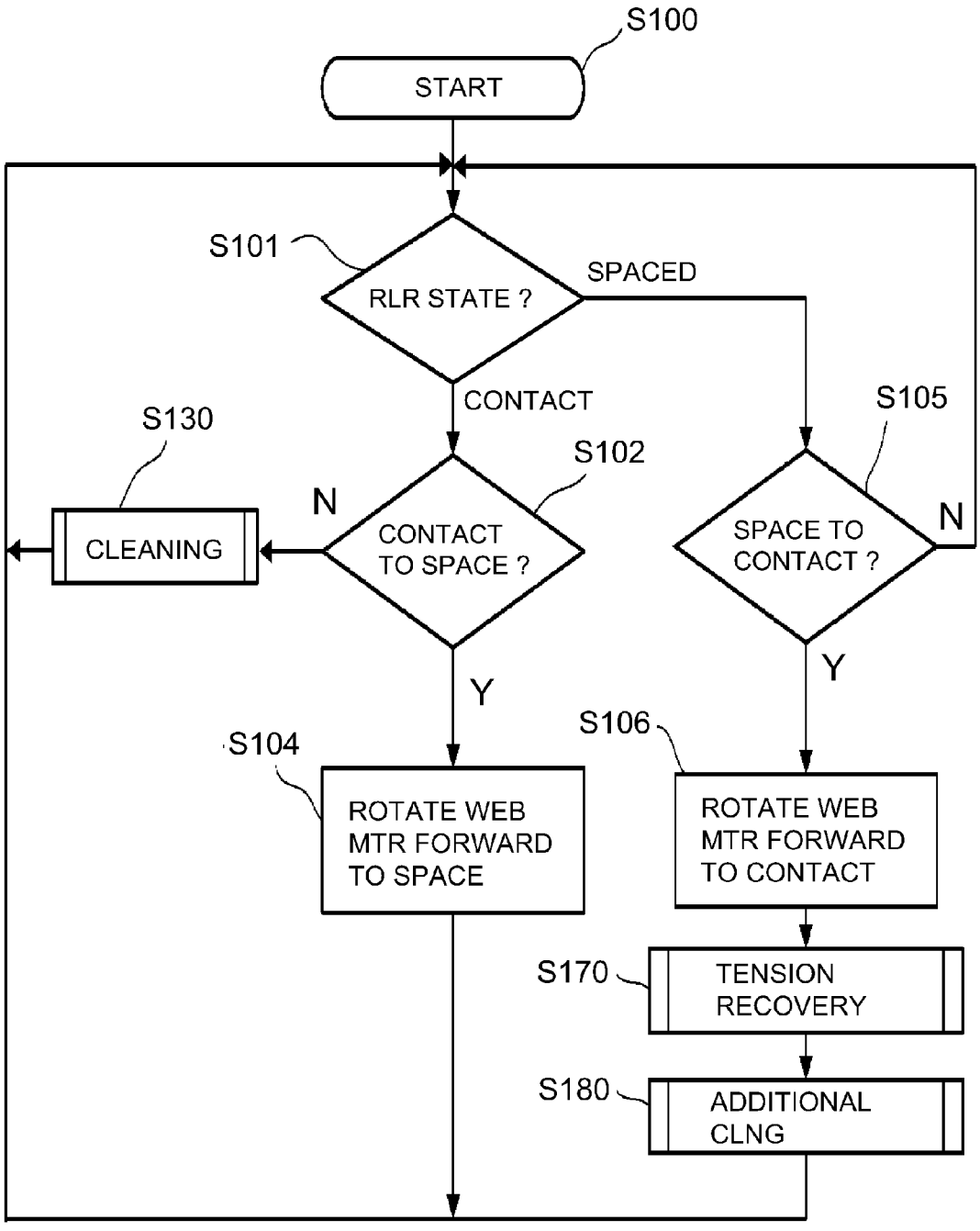

S100
START
S101
RLR STATE ?
SPACED
CONTACT
S130
S102
S105
N
CLEANING
CONTACT TO SPACE ?
SPACE TO CONTACT ?
N
Y
Y
S104
S106
ROTATE WEB MTR FORWARD TO SPACE
ROTATE WEB MTR FORWARD TO CONTACT
S170
TENSION RECOVERY
S180
ADDITIONAL CLNG

Fig. 7

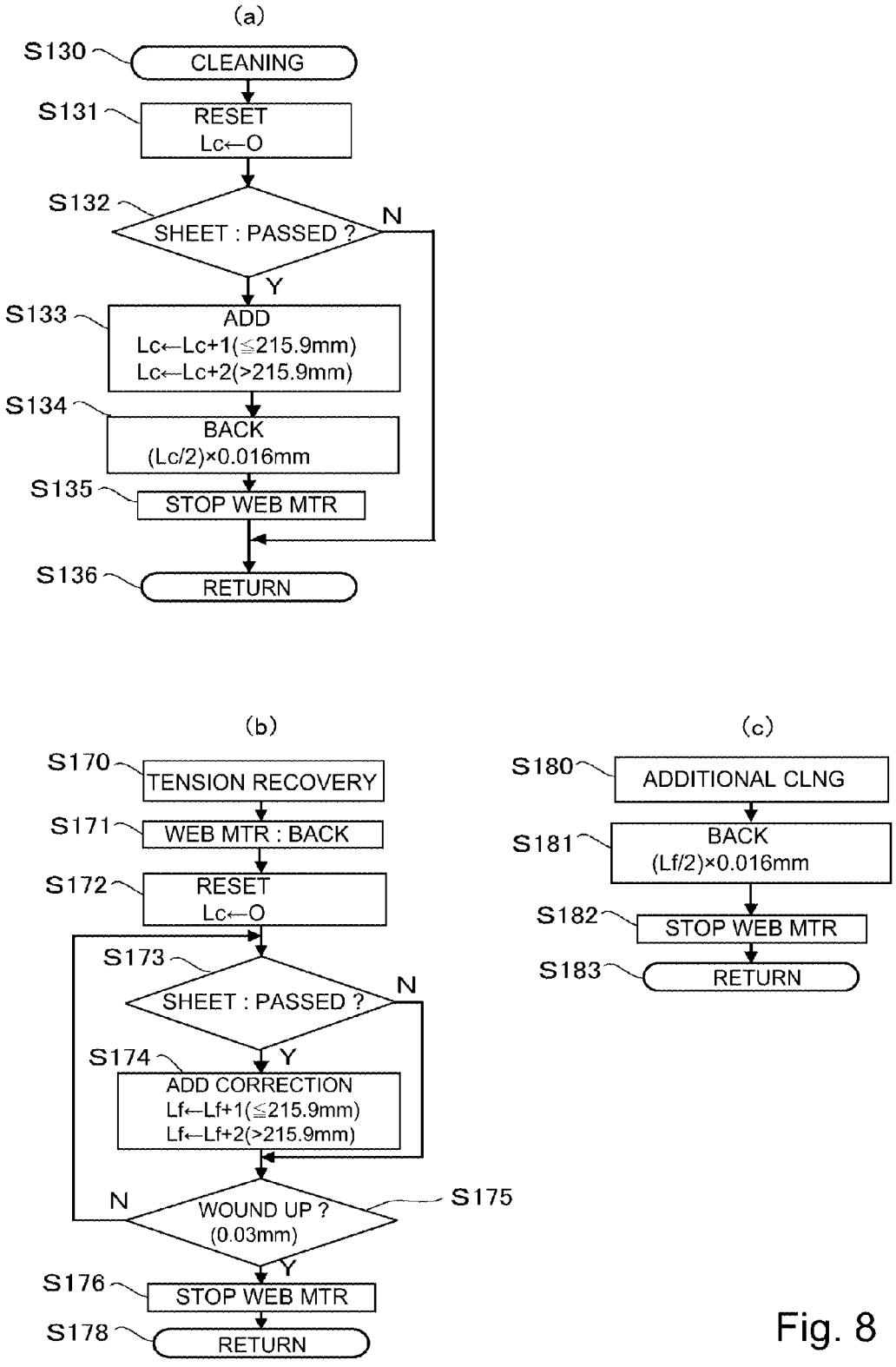

(a)
S130
CLEANING
S131
RESET
Lc←O
S132
SHEET : PASSED ?
N
Y
S133
ADD
Lc←Lc+1(≦215.9mm)
Lc←Lc+2(>215.9mm)
S134
BACK
(Lc/2)×0.016mm
S135
STOP WEB MTR
S136
RETURN
(b)
S170
TENSION RECOVERY
S171
WEB MTR : BACK
S172
RESET
Lc←O
S173
SHEET : PASSED ?
N
Y
S174
ADD CORRECTION
Lf←Lf+1(≦215.9mm)
Lf←Lf+2(>215.9mm)
N
WOUND UP ?
(0.03mm)
S175
Y
S176
STOP WEB MTR
S178
RETURN
(c)
S180
ADDITIONAL CLNG
S181
BACK
(Lf/2)×0.016mm
S182
STOP WEB MTR
S183
RETURN

Fig. 8

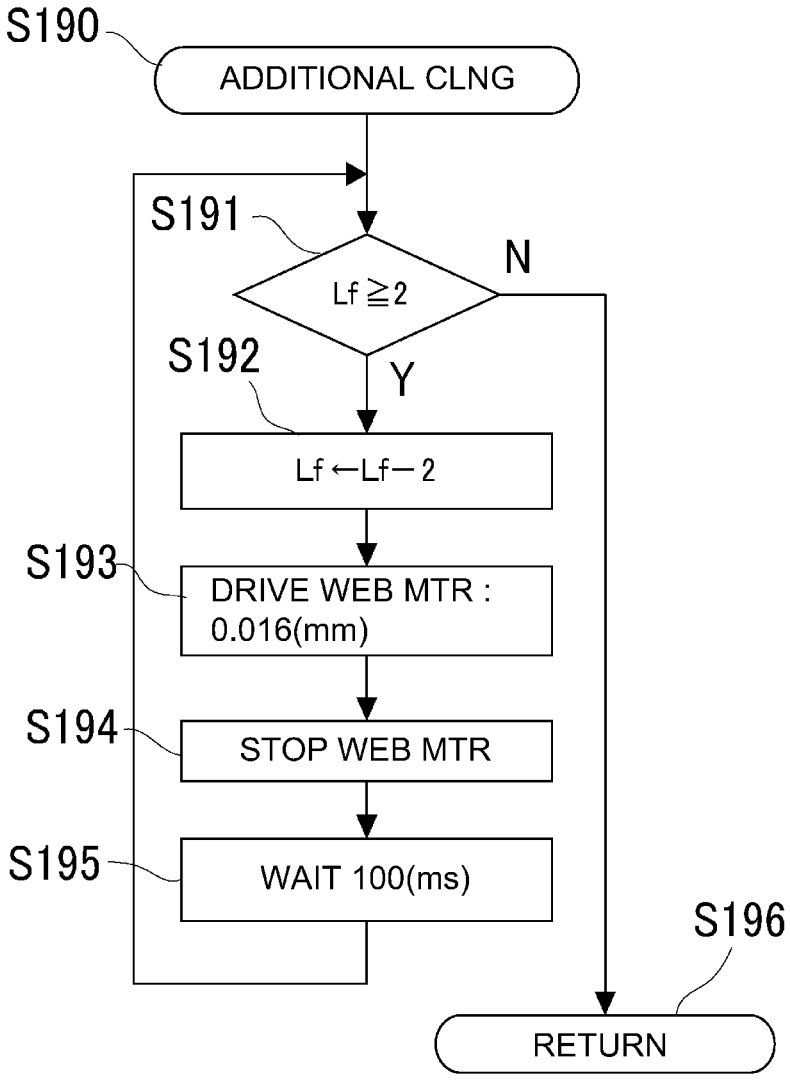

S190
ADDITIONAL CLNG
S191
Lf ≧2
N
Y
S192
Lf ←Lf− 2
S193
DRIVE WEB MTR :
0.016(mm)
S194
STOP WEB MTR
S195
WAIT 100(ms)
S196
RETURN

Fig. 9

CLEANING DEVICE AND FIXING DEVICE

FIELD OF THE INVENTION AND RELATED ART

The present invention relates to a cleaning device for cleaning a rotatable member and to a fixing device provided with it.

In an image forming apparatus of an electrophotographic type, a fixing device is provided to fix a toner image formed on the recording material (sheet) by heating and pressing.

In such a fixing device, a cleaning device has been proposed in which a fixing roller (rotatable member) is cleaned by a web (Japanese Laid-open Patent Application 2008-15444).

More specifically, the web wound around a feeding roller is wound up on a winding-up roller via a press-contact roller disposed opposite of the fixing roller. The web is gradually wound up on the winding-up roller every predetermined number of the recording materials passing through a nip.

However, an improved cleaning device is desired.

SUMMARY OF THE INVENTION

According to an aspect of the present invention, there is provided a cleaning device comprising (i) a cleaning unit for cleaning a rotatable member, said cleaning unit including, (i-i) a web; (i-ii) a first roller on which said web is wound, (i-iii) a second roller configured and positioned to wind said web up, (i-iv) a driving mechanism configured to drive said second roller, (i-v) a third roller configured and positioned to urge said web to said rotatable member, (i-vi) an urging portion configured and positioned to urge said third roller toward said rotatable member, and (i-vii) a supporting mechanism supporting said third roller, said supporting mechanism permitting movement said third roller relative to said first roller and said second roller against an urging force of said urging portion; (ii) a moving mechanism configured and positioned to cause a relative movement between said cleaning unit and said rotatable member, between a first position in which said web is spaced from said rotatable member and a second position in which said web contacts said rotatable member; and (iii) a controller configured to control an operation of said driving mechanism, wherein when said moving mechanism causes the relative movement from the first position to the second position, said controller operates said driving mechanism for a predetermined duration to substantially eliminate the slackness of said web resulting from the relative movement.

These and other objects, features and advantages of the present invention will become more apparent upon a consideration of the following description of the preferred embodiments of the present invention taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic view of an image forming apparatus.

FIG. **2** is a schematic view of a fixing device, in which (a) shows a state that a temperature uniforming roller is in a contact state, (b) shows a spaced state, and (c) shows a state after the temperature uniforming roller changes from the spaced state to the contact state.

FIG. **3** is a schematic view of a temperature uniformizing roller moving mechanism, in which (a) shows a spacing position, and (b) shows a contact position.

FIG. **4** is a schematic view illustrating an urging structure for a movement roller.

FIG. **5** is a schematic view of a temperature uniformizing roller moving mechanism and a winding-up roller.

FIG. **6** is a block diagram of a controller.

FIG. **7** is a main flow chart of a cleaning operation of a cleaning portion.

FIG. **8** is an sub-flowchart in which (a) is a flow chart showing a cleaning process, (b) is a flow chart showing a tension refreshing process, and (c) is a flow chart showing a correction cleaning process.

FIG. **9** is a flow chart showing the correction cleaning process.

DESCRIPTION OF THE EMBODIMENTS

Referring to the accompanying drawings, an image forming apparatus (fixing device) provided with a cleaning device according to the present invention will be described.

First Embodiment

General Structures of Image Forming Apparatus

As shown in FIG. **1**, an image forming apparatus **1** is a tandem full color printer of an intermediary transfer type including yellow, magenta, cyan and black image forming stations **18**Y, **18**M, **18**C, **18**K arranged along an intermediary transfer belt **108**. Around a photosensitive drum **12***y* of the yellow image forming station **18**Y, there are provided a charging roller **13***y*, an exposure device **14***y*, developing device **15***y*, a primary transfer roller **17***y* and an auxiliary charging brush **19***y*.

The photosensitive drum **12***y* is accommodated in a central portion of a process unit **11***y* and is rotated by a drum motor (unshown). The charging roller **13***y* uniformly charges the surface of the photosensitive drum **12***y*.

The exposure device **14***y* includes a laser scanner unit scanning the uniformly charged photosensitive drum **12***y* in a longitudinal direction with a laser modulated and outputted by a laser diode, using a polygonal mirror rotatable member, so that an electrostatic latent image is formed in accordance with input image information. The developing device **15***y* uses a two component developer comprising toner and carrier particles to develop the electrostatic latent image into the visualized toner image on the photosensitive drum. The developing device **15***y* is supplied with the toner from a toner bottle **16***y* filled with the toner.

The primary transfer roller **17***y* urges the endless intermediary transfer belt **108** to the photosensitive drum **12***y* to form a primary transfer portion between the intermediary transfer belt **108** and the photosensitive drum **12***y*, and is supplied with a DC voltage to transfer the toner image from the photosensitive drum **12***y* to the intermediary transfer belt **108**. The auxiliary charging brush **19***y* electrically charges untransferred toner not transferred by the primary transfer roller **17***y* to provide such toner with uniform electric charge.

The above-described structures of the image forming station **18**Y are substantially the same with the magenta, cyan and black image forming stations **18**M, **18**C, **18**K. However, only the black image forming station **18**K is different in that a potential sensor **50** for measuring a surface potential of the photosensitive drum **12***k* is provided. In addition, the black image forming station **18**K is provided with a particular charging device **51** which is different from the charging roller **13***y* of the yellow image forming station **18**Y, and the charging high voltage for the charging device **51** is adjusted on the basis of a detected value of the potential sensor **50**.

Onto the intermediary transfer belt **108**, yellow, magenta, cyan and black toner images are transferred by the image forming stations **18**Y, **18**M, **18**C and **18**K. The four color toner images carried on the intermediary transfer belt **108** are secondary-transferred all together onto the recording material (sheet) P by a secondary transfer portion T**2**. More specifically, the secondary transfer portion T**2** includes a secondary transfer roller **110** on which the intermediary transfer belt **108** is winded and a secondary transfer opposing roller **111**, in which the secondary transfer opposing roller **111** and the intermediary transfer belt **108** are contacted to each other to form a transfer nip. By the application of the DC voltage to the secondary transfer roller **110**, the toner image is secondary-transferred from the intermediary transfer belt **108** onto the recording material P fed to the secondary transfer portion T**2** from the registration roller **115**. The remaining toner on the intermediary transfer belt not secondary-transferred to the recording material P in the secondary transfer portion T**2** is collected by an intermediary transfer belt cleaner **112**.

The recording material P carrying the four color toner images is separated by curvature from the intermediary transfer belt **108** and is fed into a fixing device **141** as an image heating apparatus. The fixing device **141** heats and presses the recording material P carrying the toner image to fix the unfixed toner image on the surface of the recording material P. The recording material P carrying the fixed toner image is discharged to a sheet discharge tray **120** or an inner sheet discharge tray **121**.

<Structures of Fixing Device>

Referring to FIG. **2** through FIG. **5**, the structures of said fixing device **141** will be described. As shown in part (a) of FIG. **2**, the fixing device **141** includes an image heating portion **150** for heating the toner image formed on the recording material P, and a cleaning portion (cleaning device) **160** which will be described hereinafter in detail. The image heating portion **150** includes a heater **151**, a fixing roller (heating member) **117** which is a rotatable member heated by the heater **151**, a pressing roller (pressing member) **118** which is a rotatable member and a temperature uniforming roller **126** which is a rotatable member. The pressing roller **118** is movable toward and away from the fixing roller **117** by a pressing roller moving mechanism **153**, and forms a nip **152** for heating and feeding the recording material P in contact with the fixing roller **117**. The temperature uniforming roller **126** is a follower roller which comprises metal having a high thermal conductivity and which is movable toward and away from the pressing roller **118** by a temperature uniformizing roller moving mechanism (moving mechanism) **154** (FIG. **3**), the follower roller being rotated by the pressing roller.

As shown in FIG. **3**, the temperature uniformizing roller moving mechanism **154** comprises a temperature uniformizing roller unit **132** rotatably supporting the temperature uniforming roller **126**, and cam mechanisms **131**, **133** urging the temperature uniformizing roller unit **132**. More specifically, the temperature uniformizing roller unit **132** is rotatably together with the temperature uniformizing roller unit **132** about a unit rotation shaft **142**. The cam mechanism comprises a rotatable cam shaft **131** and a cam **133** mounted to the cam shaft **131**.

By the cam **133** abutting the temperature uniformizing roller unit **132**, the temperature uniformizing roller unit **132** moves about the unit rotation shaft **142** from a position shown in part (a) of FIG. **3** to a position shown in part (b) of FIG. **3**. By this, the temperature uniforming roller **126** is movable from a spacing position (part (b) of FIG. **2**) in which it does not contact the pressing roller **118** to a contact position (part (a)/(c) of FIG. **2**) in which it contacts the pressing roller **118**.

The contact position and the spacing position of the temperature uniforming roller **126** is selected on the basis of a number of continuous prints after a print start and/or a detected temperature by a thermister provided on the fixing roller **117**. More specifically, in this embodiment, the temperature uniforming roller **126** is moved from the spacing position to the contact position when the number of the continuous prints reaches **25**, or when the temperature detected by the thermister exceeds 225 degrees Celcius. When the temperature uniforming roller **126** contacts the pressing roller **118**, the distribution of the surface temperature of the pressing roller **118** becomes uniform so that an end portion temperature rise of the pressing roller **118** can be suppressed.

The movement from the contact position to the spacing position is carried out when a deduced heat quantity of the pressing roller **118** becomes lower than a predetermined value. More specifically, a deduced accumulation heat quantity is determined from the number of the fixed prints and the time elapsed from the completion of the printing. In this embodiment, the deducing calculation is based on the assumption that 10 W is accumulated per print, and after the printing, 50 W escapes per second. In the job of 30 sheet prints, 3000 W is accumulated, and 50 W is lost per sec, and when the predetermined value is 0 W, the temperature uniforming roller is spaced at 60 (3000/50=60) second after the print completion.

The continuous number of the continuous prints, the thermister temperature and the heat quantity estimation are determined properly by a person of ordinary skill in the art depending on the power of fixing device **141** or the like. Results of experiments and measurements on the used fixing device, values acquired by theoretical value calculation, a width of the recording material, the material of the recording material and/or a meter temperature measurement degrees value detected by a thermister provided exclusively for the control may be taken into account. In order to acquire a current angle of the cam **133** correctly, a sensor for detecting the position of the cam **133** may be additionally used.

<Cleaning Portion>

Structures of the cleaning portion (cleaning device) **160** of the fixing device **2** will be described. The cleaning portion **160** (cleaning unit) removes deposited matter (toner and paper dust or the like) deposited to the rotatable member of the image heating portion **150** (image heating apparatus). More specifically, as shown in part (a) of FIG. **2**, the cleaning unit includes a web (cleaning web **128**), a supply roller **130**, a movement roller **127**, a winding-up roller **129**, a spring **167** and a supporting mechanism **200** (FIG. **4**).

The cleaning web **128** is a web member in the form of a sheet of non-woven paper (nonwoven fabric), is wound beforehand on the supply roller **130** as a supply member, and is wound up on the winding-up roller **129** as a winding-up member. The cleaning web **128** is urged to the temperature uniforming roller **126** by a movement roller **127** at a position between the supply roller **130** and the winding-up roller **129**. In addition to the supply roller **130** and the winding-up roller **129**, the cleaning portion **160** includes a moving mechanism **154**, **127** for changing the relative position between the cleaning web **128** and the temperature uniforming roller **126**.

The moving mechanism **154**, **127** changes the relative position between and web **128** and the temperature uniforming roller **126** between a contact state (part (a) of FIG. **2**) and a spaced state (part (b) of FIG. **2**) between the cleaning web **128** and the temperature uniforming roller **126**. More specifically, the moving mechanism includes a temperature uniformizing roller moving mechanism **154** for moving the temperature uniforming roller **126** to and away from the pressing roller

118, and a movement roller 127 (urging member) for urging the cleaning web 128 toward the temperature uniforming roller 126. Around the movement roller 127, the cleaning web 128 is wound at a position between the supply roller 130 and the winding-up roller 129. A rotation shaft 127*a* of the movement roller 127 is supported swingably in the direction indicated by the arrow by the supporting mechanism 200 shown in FIG. 4. On the other hand, rotation shafts 129*a*, 130*a* of the rollers 129, 130 are supported immovably in the cleaning unit. As shown in FIG. 4, the movement roller 127 is hooked by a spring (urging portion) 167 to be urged toward the temperature uniforming roller 126 by an urging force of the spring 167.

Therefore, as shown in part (c) of FIG. 2, the cleaning web 128, when the temperature uniforming roller 126 is brought into contact to the pressing roller 118 (contact position) by the temperature uniformizing roller moving mechanism 154, the cleaning web 128 is press-contacted to the temperature uniforming roller 126 with movement roller 127. In the contact position, the cleaning web 128 is press-contacted to the temperature uniforming roller 126 by a predetermined urging force of the spring 167 (contact state). As shown in FIG. 2, a direction in which the temperature uniforming roller 126 urges the pressing roller 118 using the temperature uniformizing roller moving mechanism 154 is different from the direction in which the movement roller 127 urges the web 128 toward the temperature uniforming roller 126. Therefore, the contact pressure between the web 128 and the temperature uniforming roller 126 are to be at a proper level.

In this example, no large scale structure such as that for urging an entire cleaning unit toward the temperature uniforming roller 126 by a spring or the like is employed, but only the movement roller 127 is selectively urged by the spring. Therefore, the force for urging the web 128 to the temperature uniforming roller 126 can be assured with high accuracy by the urging force of the spring urging the movement roller 127. In other words, the contact pressure between the web 128 and the temperature uniforming roller 126 can be assured using a simple and easy structure. In this manner, the movement roller 127 can make a relative movement toward and away from the supply roller 130 and the winding-up roller 129.

As shown in FIG. 5, a driving source for the winding-up roller 129 and that for the temperature uniformizing roller moving mechanism 154 are common. More specifically, the winding-up roller 129 is rotated by power from a web motor (driving source) 134 is a driving mechanism through a power transmission mechanism 170 as a driving mechanism to wind up the cleaning web 128 wound to the supply roller 130.

The power transmission mechanism 170 is provided with two one-way clutch gears 136 and 138 (gears having respective one-way clutches), wherein idling direction of the one-way clutch gears 136 and 138 are different from each other. When the web motor 134 rotates in the forward direction (second direction), a driving gear 135 provided on the rotation shaft of the web motor 134 rotates to rotate the first one-way clutch gear 136 engaged with the driving gear 135. The first one-way clutch gear 136 engages with the cam shaft 131 only in the forward rotation to transmit the rotational force so that the power is transmitted to the temperature uniformizing roller moving mechanism 154 through the cam shaft 131. Simultaneously, the rotational force is transmitted also to the second one-way clutch gear 138 through the intermediary gear 137, but the second one-way clutch gear 138 rotates idly (it is engaged with the shaft only in the reverse rotation), so that no driving force is transmitted to the winding-up roller 129.

On the other hand, when the web motor 134 rotates in the backward direction (first direction), the first one-way clutch gear 136 rotates idly, so that no power is transmitted to the temperature uniformizing roller moving mechanism 154. On the other hand, the second one-way clutch gear 138 transmits the power to the shaft when the web motor 134 rotates in the backward direction, and therefore, the winding-up roller 129 is rotated through the gears 139, 140.

In this manner, the power transmission mechanism 170 selectively transmits the rotational force of web motor 134 in the backward direction to the roller 129, and the rotational force of the web motor 134 in the forward direction to the temperature uniformizing roller moving mechanism 154 (moving mechanism).

In this embodiment, the power transmission mechanism 170 comprises a plurality of one-way clutches, but this is not inevitable, and ordinary clutches may be used, and the number and the idling directions of the one-way clutch may be properly selectable by a person of ordinary skill in the art.

<Controller>

Referring to FIG. 6, the controller for the image forming apparatus will be described. As shown in FIG. 6, a controller 800 of the image forming apparatus 1 comprises a computer including a calculation device 801 and storing devices 802, 803 and connecting with the image forming station 18 and the fixing device 141 or the like.

More specifically, to the calculation device (CPU) 801, they are connected through ROM 802 and RAM 803. ROM 802 stores various programs and data including a fixing control program for controlling the image heating portion 150 of the fixing device 141 and a cleaning program for controlling the cleaning portion 160. The RAM 803 includes a workspace for the calculation device 801.

To the calculation device 801, an image controller 810 and a voltage output portion 806 for the control of the image forming station 18 are connected. The image controller 810 carries out the control for the laser exposure to the image data, and the image reading control from a document reader and/or network. The voltage output portion 806 outputs voltages for the charging, the exposure, the development and the transfer.

In addition, to the calculation device 801, a fixing roller driver 804, a pressing roller driver 811, the web motor 134, and a fixing sheet discharge sensor 808, for the control of the fixing device 141, are connected. The fixing roller driver 804 rotates the fixing roller 117. The pressing roller driver 811 controls the pressing roller moving mechanism 153 to move the pressing roller 118 toward and away from the fixing roller 117. The calculation device 801 controls the web motor 134 so as to control the movement of the temperature uniforming roller 126 and the winding-up of the cleaning web. In addition, the fixing sheet discharge sensor 808 detects the recording material P passing through the fixing device 141 to transmit the event to the calculation device 801.

To the calculation device 801, various drivers 807 for actuating the motors, the solenoids and the clutch, and various sensors 809 for transmitting outputs of a flag sensor and a transmitting type sensor and input and output of an AD converter are connected.

<Cleaning Operation of Temperature Uniforming Roller>

The cleaning operation for the temperature uniforming roller using the cleaning program will be described. For the cleaning of the temperature uniforming roller 126 by the cleaning portion 160 (S100 of FIG. 7), the controller 800 discriminates whether or not the temperature uniforming roller 126 is currently in contact with the pressing roller 118 (S101).

If the temperature uniforming roller **126** is in the contact position namely it is in contact with the pressing roller **118** (S**101**), the controller **800** discriminates whether to switch the temperature uniforming roller **126** from the contact position to the spacing position. If controller **800** discriminates that the contact state is to be maintained (No of S**102**), it controls the cleaning portion **160** to execute the normal cleaning process (S**130**). That is, when the temperature uniforming roller **126** continues contacting the pressing roller **118** for more than a predetermined period (No of S**102**), the web **128** is discriminated as being in contact with the temperature uniforming roller **126**. If a slack eliminate process for the web **128**, which will be described hereinafter, has been carried out, it controls the cleaning portion **160** to execute the normal cleaning process (S**130**).

Specifically, as shown in part (a) of FIG. **8**, for the start of the normal cleaning process (S**130**), the controller **800** first initializes a distance value Lc which is a value determining the winding-up amount of the cleaning web **128** (S**131**). Then, the controller **800** discriminates whether or not the recording material (sheet) P has passed through the fixing device **141**, more particularly, the nip **152** (S**132**), and if so, a distance value is incremented (S**133**).

The amount of increment is dependent on the sheet size, and in this embodiment, the increment is "1" when the sheet size is not more than 215.9 mm, and the increment is "2", when the sheet size is larger than 215.9 mm.

When the distance value Lc is incremented, the controller **800** sets the winding-up amount Lt of the cleaning web **128** to Lt=(Lc/2)×0.016 (mm) to rotate the web motor **134** through the amount corresponding to the winding-up amount Lt (S**134**). The backward rotation of the web motor **134** is transmitted to the winding-up roller **129** through the gears **135**, **136**, **137**, **138**, **139**, and **140** (FIG. **5**), so that the cleaning web **128** is wound up. When the cleaning web **128** is wound up through the winding-up amount, the controller **800** stops the rotation of the web motor **134** (S**135**) to complete the cleaning process.

The passing of the recording material P of the fixing device **141** is detected by the fixing sheet discharge sensor **808** for detecting the recording material P at the exit portion of the nip **152**. The size (length) of the recording material having passed through the fixing device **141** is determined referring to the sheet size selected in the print job in this embodiment, but it may be detected using a sensor on the basis of the time at which the fixing sheet discharge sensor **808** is actuated.

When the above-described cleaning process is completed, the controller **800** discriminates the state of the temperature uniforming roller again as shown in FIG. **7** (S**10**), and thereafter, it discriminates whether or not it is necessary to space the temperature uniforming roller **126** from the pressing roller **118**.

When the heat quantity of pressing roller **118** is not more than a predetermined value, the controller **800** discriminates that the temperature uniforming roller **126** is to be switched from the contact position to the spacing position (Y of S**102**) to rotate the web motor **134** in the forward direction (S**104**). When the web motor **134** rotates in the forward direction, the rotational force is transmitted to the cam shaft **131** through the first one-way clutch gear **136** to disengage between the temperature uniformizing roller unit **132** and the cam **133** (FIGS. **3** and **5**). By this, the temperature uniforming roller **126** is moved to the spacing position.

When the temperature uniforming roller **126** is moved to the spacing position, the controller **800** discriminates that the temperature uniforming roller **126** is spaced from the pressing roller **118** (spaced in S**101**) at the time of discrimination (S**101**). When the controller **800** discriminates that the temperature uniforming roller **126** is in the spacing position, the controller **800** discriminates whether to move the temperature uniforming roller **126** to the contact position (S**105**), and if it is not necessary to contact the temperature uniforming roller **126** to the pressing roller **118**, the spaced state is maintained (N in S**105**). At this time, the temperature uniforming roller **126** is spaced from the pressing roller **118**, and therefore, the web **128** is also spaced from the temperature uniforming roller **126**. Since the movement roller **127** is movably supported by the supporting mechanism **200**, the movement roller **127** is projected in the righthand direction as shown in part (b) of FIG. **2** by the spring **167**.

On the other hand, if the controller **800** discriminates that the temperature uniforming roller **126** is to be moved from the spacing position to the contact position (Y in S**105**), the controller **800** rotates the web motor **134** in the forward direction to shift the temperature uniforming roller **126** from the spacing position to the contact position. As a result, the temperature uniforming roller **126** contacts also to the web **128**.

When the temperature uniforming roller **126** moves from the contact position shown in part (a) of FIG. **2** to the spacing position shown in part (b) of FIG. **2**, the movement roller **127** also moves in the urging direction because the movement roller **127** is urged to the temperature uniforming roller **126** by the spring **167**. Therefore, when the temperature uniforming roller **126** is in the spacing position, the cleaning web **128** is additionally drawn out of the supply roller **130** by the movement of the movement roller **127**.

When the temperature uniforming roller **126** is moved to the contact position (as in S**106**) in this state, the movement roller **127** is pushed back to the predetermined position against the urging force of the spring **167** as shown in part (c) of FIG. **2**. Here, the cleaning web **128** which has been drawn out when the temperature uniforming roller **126** is moved to the spacing position remains in the same state, and therefore, cleaning web **128** is loosened or slacked.

In order to remove the looseness or the slack of the cleaning web **128**, the controller **800** carries out a tension recovery process (slack removing process) immediately after the movement of the temperature uniforming roller **126** from the spacing position to the contact position (S**170**). By the tension recovery process, the controller **800** winds the cleaning web **128** up until the contact surface of the cleaning web **128** to the temperature uniforming roller **126** becomes movable.

More specifically, as shown in part (b) of FIG. **8**, when the tension recovery process is carried out (S**170**), the controller **800** rotates the web motor **134** in the back line direction (S**171**) to wind the cleaning web **128** up by the winding-up roller **129** by a predetermined amount (S**175**). When the cleaning web **128** is wound up by the predetermined amount (0.3 mm in this embodiment), the web motor **134** stops (S**176**) to complete the tension recovery process (S**178**). In order to wind up 0.3 mm of the web, approximately 3 seconds (operation time of the motor **134**) is required. The value is determined through an experiment.

During the tension recovery process, the contact surface of the cleaning web **128** cannot be moved. Therefore, when the recording material passes through the fixing device during the tension recovery process, an additional cleaning process (S**180** of FIG. **7**) is carried out in which the controller **800** winds the cleaning web **128** following the completion of the tension recovery process (continuously with the web winding-up process for the removal of the looseness of the web).

In order to carry out the additional cleaning process, the controller **800** adds a distance correction value determining a

winding-up amount Ltf of the cleaning web to be wound up by the additional cleaning process during the tension recovery process. More specifically, when the backward rotation of the web motor **134** starts in the tension recovery process (S**171** of part (b) of FIG. **8**), the controller **800** initializes the distance correction value Lf (S**172**), and discriminates whether or not the recording material P passes through the fixing device **141** (S**173**).

If the recording material P has passed the fixing device **141** (Y in S**173**), the distance correction value Lf is added in accordance with the length of the recording material P having passed. When the length of the recording material P exceeds 215.99 mm, "2" is added to the distance correction value, and if it is not more than 215.99 mm, "1" is added toward the distance correction value Lf.

Then, the controller **800** continues the counting of the distance correction value Lf until the winding of the cleaning web **178** is completed (from N of S**175** to S**174**). When the tension recovery process is completed, the controller **800** executes the above-described additional cleaning process (S**180** of FIG. **7**).

More specifically, as shown in part (c) of FIG. **8**, in the execution of the additional cleaning process (S**180**), the controller **800** sets the winding-up amount Ltf in the process following the tension recovery process, on the basis of the distance correction value Lf. That is, the winding-up amount is set to Ltf=(Lf/2)×0.016 (mm), and the web motor **134** is rotated backwardly through the amount corresponding to the winding-up amount Ltf (S**181**). When the web motor **134** is rotated backwardly through the amount corresponding to the winding-up amount Ltf, the web motor **134** is stopped (S**182**), and the additional cleaning process is completed (S**183**).

As described hereinbefore, when the temperature uniforming roller **126** is shifted from the spacing position to the contact position, that is, when it is shifted from the spaced state to the contact state, the cleaning web **128** is wound up, so that the tension state of the cleaning web can be recovered. During such a winding-up operation, the fixing device **141** is capable of operating, and therefore, the productivity of the fixing device **141** is not decreased by such an operation of the cleaning portion **160**.

In said embodiment, the winding-up amount of the cleaning web **128** in the tension recovery operation is determined beforehand by experiments. However, the looseness of the cleaning web **128** can be detected, by, for example, detecting the position of the cleaning web **128**, or detecting whether or not the drive sensed by a rotary encoder provided on the movement roller **127** is transmitted to the web roller. Therefore, the winding-up amount of the cleaning web **128** may be the amount required until the looseness detected by such a sensor is eliminated. In other words, the predetermined amount is such an amount that upon the switching from the spaced state to the contact state, the stretched state with which the contact surface of the cleaning web **128** to the temperature uniforming roller **126** becomes movable by the rotation of the winding-up roller **129**.

By the following-up winding of the cleaning web **128** in accordance with the length of the recording material passing during the tension recovery winding-up operation, the deposited matter which may otherwise remain on the temperature uniforming roller **126** can be removed. By this, the damage to the pressing roller **118** by the deposited matter and the decrease of the uniform heating property of the temperature uniforming roller **126** can be prevented, and therefore, the cleaning portion **160** can keep a high cleaning performance without reduction of the productivity of the fixing device **141** (image heating portion **150**). Particularly, the temperature uniforming roller **126** of which the surface temperature tends to lower because it is not always in contact with the pressing roller **118**, involves the nature that the deposited toner thereon tends to solidify and therefore tends to become difficult to remove, but according to this embodiment, the cleaning portion **160** can remove such toner before solidification.

In this embodiment, the correction winding-up amounts are predetermined in accordance with the recording material sizes, and the predetermined value is added depending on the recording material P passed through the fixing device **141** during the winding-up operation. The amount to add is dependent on whether or not the length of the sheet is larger than 215.9 mm, that is, whether or not the sheet size is larger than A4 size, and therefore, the winding-up amount of the cleaning web **128** can be adjusted properly.

The power transmission mechanism **170** is capable of selectively transmitting the forward and backward rotations of the web motor **134** to the winding-up roller **129** and to the temperature uniformizing roller moving mechanism **154**. By using a reversible web motor **134**, the driving source may be common to the winding-up roller **129** and the temperature uniformizing roller moving mechanism **154**, so that the fixing device **141** may be compact.

Second Embodiment

Referring to FIG. **9**, a fixing device according to a second embodiment of the present invention will be described. The fixing device of the second embodiment is different from the fixing device of the first embodiment only in the control method of the additional cleaning process. In the description of this embodiment, the same reference numerals as in Embodiment 1 are assigned to the elements having the corresponding functions in this embodiment, and the detailed description thereof is omitted for simplicity.

As shown in FIG. **9**, at the start of the execution of the additional cleaning process (S**190**), a controller **800** discriminates whether or not a distance correction value Lf is not less than 2. If the distance correction value Lf is not less than 2 (Y of S**191**), the distance correction value Lf is subtracted by 2 (S**192**), and the web motor **134** is driven (S**193**).

When the cleaning web **128** is wound up by 0.016 mm, the controller **800** stops the web motor **134** (S**194**), and rests for a predetermined duration (S**195**). In this embodiment, the rest duration is 100 ms, which corresponds to one full rotation of the temperature uniforming roller **126** empirically determined.

The controller **800** repeats the operations of steps S**191**-S**195** until the distance correction value Lf becomes less than 2. If the distance correction value Lf becomes less than 2 (N of S**191**), the additional cleaning process ends (S**196**).

In this manner, in this embodiment, when a plurality of recording materials pass through the fixing device **141** during the tension recovery process, the winding of Ltf and stopping are repeated by the additional cleaning process operation. By this, a relatively larger amount of the deposited matter can be removed the cleaning web **128**, corresponding to the rest duration. When the cleaning web **128** is continuously wound up, the temperature uniforming roller **126** is cleaned with the moving cleaning web **128**, and therefore, a cleanable area of the cleaning web at a position is smaller than that in the case when the cleaning is carried out with the cleaning web **128** not moving. The cleaning performance per unit length of the web can be enhanced by cleaning with the cleaning web **128** at rest and then feeding the cleaning web **128**.

In the fixing device **141** of the first and second embodiments, the fixing roller **117** is employed as the heating mem-

ber, and the pressing roller **118** is employed as the pressing member, but the heating member and the pressing member may be films. The heater **151** for heating the heating member is not limited to a lamp heater, but may be a heater of an induction heating, resistance heating, radiation heating or heat pipe type or the like.

In this embodiment, the recording material P passing through the fixing device **141** is detected by the fixing sheet discharge sensor **808**, but it may be discriminated whether or not the recording material P passes by the timing of the recording material P passing the fixing device **141** on the basis of a drive sequence of the feeding process.

The addition to the distance value Lc or the distance correction value Lf may be made different depending on the number of the recording materials passing through the fixing device **141**, the image density (weighted thereby), or the amount of the used toner (weighted thereby).

The driving source may be provided for each of the motion of the temperature uniforming roller **126** toward and away from and the winding of the winding-up roller **129**. Furthermore, in the foregoing embodiments, the cleaning portion **160** cleans the temperature uniforming roller **126**, but the present invention is applicable to the cleaning of the pressing member and/or the heating member.

While the invention has been described with reference to the structures disclosed herein, it is not confined to the details set forth and this application is intended to cover such modifications or changes as may come within the purpose of the improvements or the scope of the following claims.

This application claims priority from Japanese Patent Application No. 195674/2012 filed Sep. 6, 2012, which is hereby incorporated by reference.

What is claimed is:

1. A cleaning device comprising:

(i) a cleaning unit for cleaning a rotatable member, said cleaning unit including,

(i-i) a web;

(i-ii) a first roller on which said web is wound,

(i-iii) a second roller configured and positioned to wind said web up;

(i-iv) a driving mechanism configured to drive said second roller,

(i-v) a third roller configured and positioned to urge said web to said rotatable member,

(i-vi) an urging portion configured and positioned to urge said third roller toward said rotatable member,

(i-vii) a supporting mechanism supporting said third roller, said supporting mechanism permitting movement of said third roller relative to said first roller and said second roller against an urging force of said urging portion;

(ii) a moving mechanism configured and positioned to cause a relative movement between said cleaning unit and said rotatable member, between a first position in which said web is spaced from said rotatable member and a second position in which said web contacts said rotatable member; and

(iii) a controller configured to control an operation of said driving mechanism,

wherein when said moving mechanism causes the relative movement from the first position to the second position, said controller operates said driving mechanism for a predetermined duration to substantially eliminate the slackness of said web resulting from the relative movement.

2. A cleaning device according to claim **1**, wherein said urging portion includes a spring.

3. A fixing device for heat fixing a toner image on a sheet in a nip, said fixing device comprising:

(i) a rotatable member;

(ii) a cleaning unit configured and positioned to clean said rotatable member, said cleaning unit including,

(ii-i) a web;

(ii-ii) a first roller on which said web is wound,

(ii-iii) a second roller configured and positioned to wind said web up;

(ii-iv) a driving mechanism configured to drive said second roller,

(ii-v) a third roller configured and positioned to urge said web to said rotatable member,

(ii-vi) an urging portion configured and positioned to urge said third roller toward said rotatable member,

(ii-vii) a supporting mechanism supporting said third roller, said supporting mechanism permitting movement of said third roller relative to said first roller and said second roller against an urging force of said urging portion;

(iii) a moving mechanism configured and positioned to cause a relative movement between said cleaning unit and said rotatable member, between a first position in which said web is spaced from said rotatable member and a second position in which said web contacts said rotatable member; and

(iv) a controller configured to control an operation of said driving mechanism,

wherein when said moving mechanism causes the relative movement from the first position to the second position, said controller operates said driving mechanism for a predetermined duration to substantially eliminate the slackness of said web resulting from the relative movement.

4. A fixing device according to claim **3**, wherein when a fixing process is carried out concurrently the slackness eliminating operation, said controller controls said driving mechanism so as to wind up said web on said second roller additionally by an amount corresponding to a number of the sheets subjected to the fixing process during the slackness eliminating operation.

5. A fixing device according to claim **4**, wherein in the additional winding up operation, said controller controls said driving mechanism so as to wind up said web intermittently.

6. A fixing device according to claim **3**, wherein when said rotatable member is continuously in the contact position, said controller controls said driving mechanism so as to wind up a predetermined amount for each passages of a predetermined number of sheets through said nip.

7. A fixing device according to claim **3**, wherein said urging portion includes a spring.

8. A fixing device according to claim **3**, further comprising a second rotatable member and a third rotatable member which form the nip,

wherein, when said cleaning unit and said rotatable member are in the second position, said rotatable member and said second rotatable member are in contact.

9. A fixing device comprising:

a first rotatable member and a second rotatable member configured and positioned to form a nip effective to heat fix a toner image on a sheet,

(ii) a heat conduction rotatable member configured to contact said first rotatable member and conduct heat of said first rotatable member in a direction of an axis thereof;

(iii) a moving mechanism configured and positioned to move said heat conduction rotatable member relative to said first rotatable member between a contact position in

which said heat conduction rotatable member contacts said first rotatable member and a spacing position in which said heat conduction rotatable member is spaced from said first rotatable member;

(iv) a cleaning unit configured and positioned to clean said heat conduction rotatable member, said cleaning unit comprising,

(iv-i) a web;

(iv-ii) a first roller on which said web is wound,

(iv-iii) a second roller configured and positioned to wind said web up;

(iv-iv) a driving mechanism configured to drive said second roller,

(iv-v) a third roller configured and positioned to urge said web to said heat conduction rotatable member;

wherein said cleaning unit is disposed at such a position that with movement of said heat conduction rotatable member from the contact position to the spacing position, said heat conduction rotatable member moves from the contact position to the spacing position, and

wherein said cleaning unit includes an urging portion configured and positioned to urge said third roller toward said heat conduction rotatable member, and a supporting mechanism supporting said third roller and permitting relative movement of said third roller relative to said first roller and said second roller against an urging force of said urging portion.

10. A fixing device according to claim **9**, further comprising a controller configured to control an operation of said driving mechanism, wherein when said heat conduction rotatable member moves from the spacing position to the contact position, said controller controls said driving mechanism to wind up said web to eliminate slackness of said web resulting from the movement of said heat conduction rotatable member.

11. A fixing device according to claim **10**, wherein when a fixing process is carried out concurrently the slackness eliminating operation, said controller controls said driving mechanism so as to wind up said web on said second roller additionally by an amount corresponding to a number of the sheets subjected to the fixing process during the slackness eliminating operation.

12. A fixing device according to claim **11**, wherein in the additional winding up operation, said controller controls said driving mechanism so as to wind up said web intermittently.

13. A fixing device according to claim **10**, wherein when said rotatable member is continuously in the contact position, said controller controls said driving mechanism so as to wind up a predetermined amount for each passages of a predetermined number of sheets through said nip.

14. A fixing device according to claim **9**, wherein said urging portion includes a spring.

15. A cleaning device comprising:

(i) a cleaning unit for cleaning a rotatable member, said cleaning unit including,

(i-i) a web contactable to said rotatable member at a contact surface,

(i-ii) a first roller on which said web is wound,

(i-iii) a second roller configured and positioned to wind said web up;

(i-iv) a driving mechanism configured to drive said second roller,

(i-v) a contact member contacted to a surface of said web opposite the contact surface,

(i-vi) a supporting mechanism supporting said contact member, said supporting mechanism being capable of permitting said contact member to move between a first position and a second position which is closer to said first roller and said second roller than the first position,

(i-vii) an urging portion configured to urge said contact member in a direction from the second position to the first position,

(ii) moving mechanism configured and positioned to cause a relative movement between said cleaning unit and said rotatable member so that said web takes a spaced position in which said web is in contact with said contact member placed in the first position and in which said web is spaced from said rotatable member or takes a nipped position in which said web is nipped between said rotatable member and said contact member placed in the second position

(iii) a controller configured to control an operation of said driving mechanism,

wherein when said moving mechanism causes the relative movement from the spaced position to the nipped position, said controller operates said driving mechanism for a predetermined duration to substantially eliminate the slackness of said web resulting from movement of said contact member from the first position to the second position.

16. A cleaning device according to claim **15**, wherein said urging portion includes a spring.

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